

Clinical Guideline for the Diagnosis, Evaluation, and Management of Adults and Children with Asthma-2005

Criteria that suggest the diagnosis of Asthma:

- ▶ The symptoms of dyspnea, cough and/or wheezing, especially with nocturnal symptoms;
- ▶ With acute episodes: hyperinflation of thorax, decrease of breath sounds, higher pitched wheezing, and use of accessory muscles;
- ▶ Reversible airflow obstruction of 12 to 15 % or greater (of FEV_1) if able to perform spirometry, (usually > 6 years of age), or a significant clinical improvement after a short acting bronchodilator such as albuterol;
- ▶ Alternative diagnoses are excluded.

Good Control of Asthma means:

- ▶ Minimal (or no) chronic symptoms, including nocturnal symptoms;
- ▶ Minimal (or no) exacerbations;
- ▶ No emergency visits or hospitalizations;
- ▶ Minimal (or no) need for p.r.n. (as needed) β_2 -agonist, e.g. generally < 2x per week (for severe asthmatics once daily or less is acceptable);
- ▶ No limitations on activities, including exercise;
- ▶ No school or work missed;
- ▶ PEF circadian variation of less than 20 %;
- ▶ (Near) normal PEF (> 80 % of personal best);
- ▶ Minimal (or no) adverse effects from medications.

4 Key Components for Long-Term Control of Asthma

Stepwise Classification & Therapy Recommendations

Long-Term-Control Medications Estimated Comparative Daily Dosages

Long-Term-Control Medications Usual Dosages

Quick-Relief Medications Usual Dosages

Developed by the New York State Consensus Asthma Guideline Expert Panel, and endorsed by the New York State Department of Health, New York City Department of Health and Mental Hygiene, New York State Health Plan Association, New York State Coalition of Prepaid Health Services Plans, Empire Blue Cross Blue Shield, Medical Society of the State of New York, New York State Academy of Family Physicians, New York Chapter American College of Physicians, American Academy of Pediatrics, District II, New York State Thoracic Society, and the American Lung Association of New York. Funded in part by the Centers for Disease Control and Prevention.

Four Key Components for Long-Term Control of Asthma

① Assessment and Monitoring

Components of medical history and physical exam:

- ▶ Assess and document asthma severity (see Stepwise charts);
- ▶ Identify triggers and precipitating factors (e.g. allergens, exercise, upper respiratory infection, tobacco smoke, weather);
- ▶ Family, psychosocial and occupational history, including stressors.
- ▶ Medication use, including complementary alternative medications. At every patient visit review beta₂-agonist use.
- ▶ Physical exam focusing on upper and lower airways and skin.

Recommended Approach to Care Management

Initial asthma visit

- ▶ Conduct medical history and physical exam.
- ▶ Assess severity; develop and review written Asthma Action Plan (see section 4).
- ▶ Perform spirometry measurements (FEV₁, FVC, FEV₁/FVC) before and after the patient inhales a short-acting inhaled bronchodilator (usually can be done by children > 6 years of age).
- ▶ Provide education (see section 4).

Chronic maintenance asthma visit

- ▶ Conduct focused medical history and physical exam.
- ▶ Assess severity; update and review written Asthma Action Plan.
- ▶ Schedule a medical appointment for asthma at least every six months and prior to predicted seasonal exacerbations.
- ▶ See patients with frequent exacerbations or symptoms at least every three months.
- ▶ Provide/recommend influenza vaccine annually.
- ▶ Perform spirometry measurements at least every 1 to 2 years when asthma is stable, more often when asthma is unstable, or at other times when clinically indicated by a change in the patient's condition (usually can be done by children > 6 years of age).
- ▶ Discuss information on reducing exposure to relevant allergens or irritants.
- ▶ Provide education, emphasizing medication adherence and medication administration technique.

Acute exacerbation asthma visit

- ▶ Conduct focused medical history and physical exam.
- ▶ Assess severity; update and review written Asthma Action Plan.
- ▶ Check patient's inhaler, spacer/holding chamber, and peak flow technique.
- ▶ Provide education.
- ▶ Review symptom/peak flow monitoring.
- ▶ Review medication adherence and assess barriers, including financial.
- ▶ Discuss information on reducing exposure to relevant allergens or irritants.

Referrals

Asthma Specialist

- ▼ Consider consultation with an asthma specialist, such as an allergist or pulmonologist, when:
 - ▶ there is difficulty in diagnosing asthma;
- ▼ the patient has a diagnosis of asthma, is currently under appropriate management, **and** has experienced any of the following:
 - ▶ multiple hospitalizations with a diagnosis of asthma;
 - ▶ multiple asthma related emergency department/urgent visits within one year;
 - ▶ substantial interference exists with quality of life;
 - ▶ prolonged or frequent bursts of oral steroids;
 - ▶ life threatening asthma exacerbation e.g. ICU admission, intubation;
 - ▶ unresponsive to prescribed therapy or has not achieved expected goals (e.g. continued need for beta₂-agonist use > 1 canister per month);
 - ▶ moderate to severe persistent asthma.

Behavioral Health Specialist

- ▶ Refer patients with significant psychiatric, psychosocial, or family stressors, which adversely affects their asthma control, to a behavioral health professional for treatment.

Health Plan and Community Agencies

- ▼ Contact individual health plan, local health department, or community agency for availability of:
 - ▶ Case management, including one-to-one comprehensive asthma education.
 - ▶ Asthma classes/support groups.
 - ▶ Smoking cessation classes.
 - ▶ Assistance with durable medical equipment and medical supplies, such as peak flow meters, spacers/holding chambers, nebulizers and compressors.
 - ▶ Home environmental assessment and remediation when possible.

Occupational Lung Disease

- ▶ Notify the New York State Department of Health Occupational Lung Disease Registry at 1-866-807-2130 of patients suspected of having occupational asthma/lung disease. Services may include education and workplace evaluations.

② Pharmacological Therapy

Stepwise Approach to Asthma Management

- ▶ Gain control as quickly as possible; then decrease treatment to the least medication necessary to maintain control. The preferred approach is to start with more intensive therapy in order to more rapidly suppress airway inflammation and thus gain prompt control.
- ▶ Provide a rescue plan of systemic corticosteroids or other medications if needed for acute exacerbations at any step.
- ▶ **Reinforce to all persistent asthmatics that daily inhaled corticosteroids are the preferred first line treatment that results in improved asthma control.**
- ▶ For pregnant patients with asthma refer to Managing Asthma During Pregnancy: Recommendations for Pharmacologic Treatment

Four Key Components for Long-Term Control of Asthma

– Update 2004 at <http://www.nhlbi.nih.gov/health/prof/lung/asthma/astpreg.htm>.

See Long-Term-Control and Quick-Relief charts for medications and usual dosages. Check for availability and the health plan/insurance formulary when applicable.

③ Control of Factors Contributing to Asthma Severity

Environmental Control Measures

For the patient's environments (e.g., home, workplace, child-care, school) the medical practitioner should:

- ▶ Assess the patient's exposure to and clinical significance of: irritants (e.g., smoke, chemicals) and allergens (e.g., animal dander, dust mites, cockroaches, mold, pollen, chemicals) and consider allergen testing.
- ▼ Provide information to the patient on: reducing exposure to relevant allergens and irritants, and preventing infections. For example: **tobacco smoke exposure**
 - ▶ Assess for smoking or exposure to second hand smoke.
 - ▶ Routinely advise and encourage patients/family to quit smoking. Advise no smoking indoors or in automobiles.
 - ▶ Initiate and/or refer to smoking cessation interventions and counseling and consider pharmacotherapy for patients and household members.
- ▶ Inform patients that smoking cessation information and **free Stop Smoking Kits** are available through the New York State Smokers' Quitline. The toll free number is 1-888-609-6292, or visit the website at www.nysmokefree.com.

Co-Morbidity Management

- ▶ Manage, if present: rhinitis/sinusitis, GERD, respiratory tract infections, and obesity.

④ Patient Education

Effective partnerships between practitioners and patients produce better patient outcomes through the use of evidence-based techniques that emphasize patient responsibility, empowerment, collaborative goal setting and problem solving skills. Consider educational level and cultural background when providing asthma education. Health plans and community agencies may be able to support patient education as well as home remediation.

Asthma Education Includes:

- ▶ **Basic Facts About Asthma:** what is asthma; basic pathophysiology; what happens during an attack; early warning signs and symptoms; physical activity and asthma.
- ▶ **Roles of Medication and Techniques for Using Medication Devices:** how medications work; two types of medications—quick-relief and controller; importance of long-term controller medications; skill training on inhaler, spacer/holding chamber, nebulizer and peak flow technique.
- ▶ **Environmental Control Measures at home, school, and work:** identification and remediation of environmental and/or occupational triggers or exposure.

- ▶ **Self Management Plan:** what is chronic disease; patient responsibility in managing asthma; use of patient self management tools.

Written Asthma Action Plan

A written Asthma Action Plan based on peak flow and/or symptom monitoring developed jointly with the patient, assists in managing asthma exacerbations. Update the Asthma Action Plan at least every six months.

▼ A written Asthma Action Plan should include:

- ▶ Recommended doses and frequencies of daily controller medications and quick-relief medications.
- ▶ Information on what to do in case of an exacerbation (worsening symptoms and/or nocturnal awakenings).
- ▶ How to adjust medicines at home in response to particular signs, symptoms, and/or peak flow measurements.
- ▶ A list of Peak Expiratory Flow (PEF) levels and symptoms indicating the need for acute care.
- ▶ When and how to activate the EMS (Emergency Medical System) including emergency telephone numbers for the physician, and rapid transportation.

▼ A copy of a patient's written Asthma Action Plan should be:

- ▶ Carried with the patient.
- ▶ In the patient's medical record.
- ▶ Provided to the patient's family.
- ▶ Provided to the patient's school/daycare.
- ▶ Provided to other contacts of the patient as needed.

▼ Free Asthma Related Materials

- ▶ Free Asthma related materials, including asthma guideline tool and Asthma Action Plans (English and Spanish) are available at www.health.state.ny.us. Click on Diseases and Conditions, click on Asthma, click on Asthma Action Plan and Informational Material (www.health.state.ny.us/nysdoh/diseases/asthma/brochures.htm).

Bibliography

- ▶ Guidelines for the Diagnosis and Management of Asthma, Expert Panel Report 2. NIH Publication No. 97-4051, April 1997.
- ▶ Guidelines for the Diagnosis and Management of Asthma, Update on Selected Topics 2002, NAEPP Expert Panel Report. NIH Publication No. 02-5075, June 2002.
- ▶ Asthma and Pregnancy – Update 2004. NAEPP Working Group Report on Managing Asthma During Pregnancy: Recommendations for Pharmacologic Treatment – Update 2004. NIH Publication No. 05-3279. Bethesda, MD: U.S. Department of Health and Human Services; National Institutes of Health; National Heart, Lung, and Blood Institute, 2004.
- ▶ Centers for Disease Control and Prevention. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2001; 50(No. RR-4): page8.
- ▶ www.nhlbi.nih.gov/guidelines/asthma
- ▶ www.ginasthma.com

Guidelines are intended to be flexible. They serve as recommendations, not rigid criteria. Guidelines should be followed in most cases, but depending on the patient, and the circumstances, guidelines may need to be tailored to fit individual needs.

Stepwise Approach for Managing Acute or Chronic Asthma Infants and Young Children (5 Years of Age and Younger)

Classify Severity: Clinical Features Before Treatment or Adequate Control			Medications Required to Maintain Long-Term Control		Recommendations
		Symptoms/Day	Exercise Tolerance	Daily Medications	Education/Recommendations
		Symptoms/ Night			
Intermittent Asthma	Mild Intermittent	≤2 days/week	Excellent exercise tolerance	▶ No daily medication needed.	For all levels of severity: ▶ Teach basic facts about asthma. ▶ Identify triggers and discuss avoidance measures. ▶ Discuss goals of optimal control. ▶ Teach inhaler/spacer/nebulizer techniques. ▶ Discuss role of medication and assess for use of complementary alternative medications. ▶ Develop and review written Asthma Action Plan with parent(s). ▶ Discuss management related to exercise. ▶ Emphasis on when to call for advice/ appointment. ▶ Provide/recommend influenza vaccine annually. ▶ Discuss smoking cessation with parent(s) if environmental tobacco smoke exposure is a risk factor. ▶ Home environmental assessment. ▶ Address questions related to long-term steroid use and emphasize maintenance during periods of wellness. ▶ Monitor for corticosteroid systemic effects. ▶ Consider specialist consultation for patients under age three who require Step 2 care ▶ Specialist consultation for patients requiring Step 3 or 4 care.
	①	≤2 nights/month			
Persistent Asthma	Mild Persistent	>2/week but <1x/day	Exercise symptoms	▼ Preferred treatment: ▶ Low-dose inhaled corticosteroids (with nebulizer or MDI with holding chamber with or without face mask or DPI).	
	②	>2 nights/month		▼ Alternative treatment (listed alphabetically): ▶ Cromolyn (nebulizer is preferred or MDI with holding chamber) OR ▶ leukotriene receptor antagonist.	
	Moderate Persistent	Daily	Frequent exercise symptoms	▼ Preferred treatment: ▶ Low-dose inhaled corticosteroids and long-acting inhaled beta ₂ -agonists OR ▶ Medium-dose inhaled corticosteroids.	
				▼ Alternative treatment: ▶ Low-dose inhaled corticosteroids and either leukotriene receptor antagonist or theophylline.	
		③	>1 night/week	If needed (particularly in patients with recurring severe exacerbations): ▼ Preferred treatment: ▶ Medium-dose inhaled corticosteroids and long-acting beta ₂ -agonists. ▼ Alternative treatment: ▶ Low-dose inhaled corticosteroids and either leukotriene receptor antagonist or theophylline.	
	Severe Persistent	Continual	Exercise severely limited	▼ Preferred treatment: ▶ High-dose inhaled corticosteroids AND ▶ Long-acting inhaled beta ₂ -agonists	
④		Frequent		AND, if needed ▶ Corticosteroid tablets or syrup long term (see chart for medication usual dosages). (Make repeat attempts to reduce systemic corticosteroids and maintain control with high-dose inhaled corticosteroids.)	
Quick Relief All Patients		▶ Short-acting bronchodilator: 2 puffs short-acting inhaled beta ₂ -agonists q 4 to 6 hours as needed for symptoms. The guidelines have indicated for severe exacerbations as many as 2 to 10 puffs as often as q 2 to 4 hours may be necessary. ▶ Intensity of treatment will depend on severity of exacerbation; up to 3 treatments at 20-minute intervals either by inhaler or by nebulizer as necessary. A course of systemic corticosteroids may also be needed. ▶ Use of short-acting beta ₂ -agonists > 2 times a week in intermittent asthma (daily, or increasing use in persistent asthma) may indicate the need to initiate (increase) long-term control therapy.			

Adults and Children Older Than 5 Years of Age

Classify Severity: Clinical Features Before Treatment or Adequate Control			Medications Required to Maintain Long-Term Control		Recommendations
		Symptoms/Day	PEF or FEV ₁	Daily Medications	Education/Recommendations
		Symptoms/ Night	PEF Vari- ability		
Intermittent Asthma	Mild Intermittent	≤ 2 days/week	≥ 80 %	▶ No daily medication needed.	For all levels of severity: <ul style="list-style-type: none">▶ Teach basic facts about asthma.▶ Identify triggers and discuss avoidance measures.▶ Discuss goals of optimal control.▶ Teach inhaler/spacer/nebulizer techniques.▶ Discuss role of medication and assess for use of complementary alternative medications.▶ Develop and review written Asthma Action Plan (with parent(s) as appropriate).▶ Discuss management related to exercise.▶ Emphasis on when to call for advice/ appointment.▶ Provide/recommend influenza vaccine annually.▶ Discuss smoking cessation (with parent(s) as appropriate) if environmental tobacco smoke exposure is a risk factor.▶ Home environmental assessment.▶ Teach Peak Flow meter use.▶ Address questions related to long-term steroid use and maintenance during periods of wellness.▶ Monitor for corticosteroid systemic effects.▶ Specialist consultation for patients requiring Step 3 or 4 care.
	①	≤ 2 nights/month	< 20 %	▶ Severe exacerbations may occur, separated by long periods of normal lung function and no symptoms. A course of systemic corticosteroids is recommended.	
Persistent Asthma	Mild Persistent	> 2/week but < 1x/day	≥ 80 %	▼ Preferred treatment: <ul style="list-style-type: none">▶ Low-dose inhaled corticosteroids	
	②	> 2 nights/month	20 - 30 %	▼ Alternative treatment (listed alphabetically): <ul style="list-style-type: none">▶ Cromolyn, leukotriene modifier, nedocromil, OR sustained release theophylline to serum concentration of 5 - 15 mcg/mL.	
	Moderate Persistent	Daily	> 60 % - < 80 %	▼ Preferred treatment: <ul style="list-style-type: none">▶ Low-to-medium dose inhaled corticosteroids and long-acting inhaled beta₂-agonists.	
			▼ Alternative treatment (listed alphabetically): <ul style="list-style-type: none">▶ Increase inhaled corticosteroids within medium-dose range OR▶ Low-to-medium dose inhaled corticosteroids and either leukotriene modifier or theophylline.		
		> 1 night/week	> 30 %	If needed (particularly in patients with recurring severe exacerbations): ▼ Preferred treatment: <ul style="list-style-type: none">▶ Increase inhaled corticosteroids within medium-dose range and add long-acting inhaled beta₂-agonists. ▼ Alternative treatment: <ul style="list-style-type: none">▶ Increase inhaled corticosteroids within medium-dose range and add either leukotriene modifier or theophylline.	
	Severe Persistent	Continual	≤ 60 %	▼ Preferred treatment: <ul style="list-style-type: none">▶ High-dose inhaled corticosteroids AND▶ Long-acting inhaled beta₂-agonists	
④		Frequent	> 30 %	AND, if needed <ul style="list-style-type: none">▶ Corticosteroid tablets or syrup long term (see chart for medication usual dosages). (Make repeat attempts to reduce systemic corticosteroids and maintain control with high-dose inhaled corticosteroids.)	
Quick Relief All Patients		<ul style="list-style-type: none">▶ Short - acting bronchodilator: 2 puffs short - acting inhaled beta₂-agonists q 4 to 6 hours as needed for symptoms. The guidelines have indicated for severe exacerbations as many as 2 to 10 puffs as often as q 2 to 4 hours may be necessary.▶ Intensity of treatment will depend on severity of exacerbation; up to 3 treatments at 20-minute intervals either by inhaler or by nebulizer as necessary. A course of systemic corticosteroids may also be needed.▶ Use of short-acting beta₂-agonists > 2 times a week in intermittent asthma (daily, or increasing use in persistent asthma) may indicate the need to initiate (increase) long-term control therapy.			

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Usual Dosages for Long-Term Control Medications

Inhaled Corticosteroids: preferred first line therapy Estimated Comparative Daily Dosages

	Low Daily Dose		Medium Daily Dose		High Daily Dose	
Drug/Frequency	Adult	Child *	Adult	Child *	Adult	Child *
Beclomethasone HFA/bid 40 or 80 mcg/puff	80 - 240 mcg	80 - 160 mcg	240 - 480 mcg	160 - 320 mcg	> 480 mcg	> 320 mcg
Budesonide DPI/qd to bid 200 mcg/inhalation Inhalation suspension for nebulization (child dose)	200 - 600 mcg	200 - 400 mcg 0.5 mg	600 - 1,200 mcg	400 - 800 mcg 1.0 mg	> 1,200 mcg	> 800 mcg 2.0 mg
Flunisolide/bid 250 mcg/puff	500 - 1,000 mcg	500 - 750 mcg	1,000 - 2,000 mcg	1,000 - 1,250 mcg	> 2,000 mcg	> 1,250 mcg
Fluticasone/bid MDI: 44, 110, or 220 mcg/puff DPI: 50, 100, or 250 mcg/inhalation	88 - 264 mcg 100 - 300 mcg	88 - 176 mcg 100 - 200 mcg	264 - 660 mcg 300 - 600 mcg	176 - 440 mcg 200 - 400 mcg	> 660 mcg > 600 mcg	> 440 mcg > 400 mcg
Triamcinolone Acetonide/bid to qid 100 mcg/puff	400 - 1,000 mcg	400 - 800 mcg	1,000 - 2,000 mcg	800 - 1,200 mcg	> 2,000 mcg	> 1,200 mcg

Other Long-Term Control Medications

Medication	Dosage Form	Adult Dose	Child dose *
Mometasone Furoate inhalation powder/ qd to bid	220 mcg/inhalation	1 to 2 inhalations	1 to 2 inhalations
Combined Medication			
Fluticasone/Salmeterol	DPI 100, 250, or 500 mcg/50 mcg	1 inhalation bid; dose depends on severity of asthma	1 inhalation bid; dose depends on severity of asthma
Cromolyn and Nedocromil			
Cromolyn Nedocromil	MDI 1 mg/puff Nebulizer 20 mg/ampule MDI 1.75 mg/puff	2-4 puffs tid-qid 1 ampule tid-qid 2-4 puffs bid-qid	1-2 puffs tid-qid 1 ampule tid-qid 1-2 puffs bid-qid

Leukotriene Modifiers

Montelukast	4 or 5 mg chewable tablet 10 mg tablet	10 mg qhs	4 mg oral granules qhs (12 mos-5 yrs) 4 mg chewable tablet qhs (2-5 yrs) 5 mg chewable tablet qhs (6-14 yrs) 10 mg qhs (> 14 yrs)
Zafirlukast	10 or 20 mg tablet	40 mg daily (20 mg tablet bid)	20 mg daily (7-11 yrs) (10 mg tablet bid)
Zileuton	300 or 600 mg tablet	2,400 mg daily (give tablets qid)	

Long-Acting Inhaled Beta₂-Agonists

(Should not be used for symptom relief or for exacerbations. Generally used with inhaled corticosteroids).

Formoterol Salmeterol	DPI 12 mcg/single-use capsule DPI 50 mcg/blister	1 capsule q 12 hours 1 blister q 12 hours	1 capsule q 12 hours 1 blister q 12 hours
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Methylxanthines (Serum monitoring is important [serum concentration of 5-15 mcg/mL at steady state]).

Theophylline	Liquids, sustained-release tablets, and capsules	Starting dose 10 mg/kg/day up to 300 mg max; usual max 800 mg/day	Starting dose 10 mg/kg/day; usual max: < 1 year of age: 0.2 (age in weeks) + 5 = mg/kg/day ≥ 1 year of age: 16 mg/kg/day
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Systemic Corticosteroids

Methylprednisolone Prednisolone Prednisone	2, 4, 8, 16, 32 mg tablets 5 mg tablets 5 mg/5 cc 15 mg/5 cc 1, 2.5, 5, 10, 20, 50 mg tablets 5 mg/cc, 5 mg/5 cc	7.5 - 60 mg daily in a single dose in a.m. or qod as needed for control (applies to all three corticosteroids) Short-course "burst" to achieve control: 40 - 60 mg per day as single or 2 divided doses for 3 - 10 days (applies to all three corticosteroids)	0.25 - 2 mg/kg daily in single dose in a.m. or qod as needed for control (applies to all three corticosteroids) Short-course "burst": 1 - 2 mg/kg/day, maximum 60 mg/day for 3 - 10 days (applies to all three corticosteroids)
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Anti-IgE

Omalizumab is an injectable drug used in the treatment of allergic asthma. It is used for people with moderate to severe persistent asthma who are inadequately controlled with Step Therapy, including: inhaled corticosteroids, long acting inhaled beta 2-agonists, leukotriene receptor antagonist, theophylline, etc. Treatment should be administered in conjunction with ongoing specialty treatment. See package insert for dosage and administration details.

* Children ≤ 12 years of age (Please refer to package insert for age appropriateness and drug interactions)
Above list not all inclusive. Check for availability and health plan/insurance formulary when applicable.

Use of a spacer/holding chamber is recommended with the use of a metered-dose inhaler (MDI).

Usual Dosages for Quick-Relief Medications

Medication	Dosage Form	Adult Dose	Child Dose *
Short Acting Inhaled Beta₂-Agonists			
Albuterol Albuterol HFA	90 mcg/puff, 200 puffs 90 mcg/puff, 200 puffs	<ul style="list-style-type: none"> ► Treatment of acute episodes 2 puffs q 4 - 6 hours as needed ☼ ► Exercise-induced bronchospasm prevention: 2 - 4 puffs 5 - 15 minutes prior to exercise 	<ul style="list-style-type: none"> ► Treatment of acute episodes 2 puffs q 4 - 6 hours as needed ☼ ► Exercise-induced bronchospasm prevention: 2 - 4 puffs 5 - 15 minutes prior to exercise
Pirbuterol	200 mcg/puff, 400 puffs	2 puffs q 4 - 6 hours as needed ☼	2 puffs q 4 - 6 hours as needed ☼
Albuterol	Nebulizer solution 5 mg/mL (0.5%) 2.5 mg/mL 1.25 mg/3 mL 0.63 mg/3 mL	1.25 - 5 mg in 3 cc of saline q 4 - 8 hours	0.05 mg/kg (min. 1.25 mg, max. 2.5 mg) in 3 cc of saline q 4 - 6 hours
Levalbuterol (R-albuterol)	Nebulizer solution 0.31 mg/3 mL 0.63 mg/3 mL 1.25 mg/3 mL	0.63 mg - 2.5 mg q 4 - 8 hours	0.025 mg/kg (min. 0.63 mg, max. 1.25 mg) q 4 - 8 hours

☼ The guidelines have indicated for severe exacerbations as many as 2-10 puffs as often as q 2 - 4 hours may be necessary.

Anticholinergics - alternatives if patients do not tolerate Beta₂-Agonists:

Ipratropium	MDI 18 mcg/puff, 200 puffs	2 - 3 puffs q 6 hours	1 - 2 puffs q 6 hours
	Nebulizer solution 0.25 mg/mL (0.025%)	0.25 mg q 6 hours	0.25 - 0.5 mg q 6 hours
Ipratropium with albuterol	MDI 18 mcg/puff of ipratropium bromide and 90 mcg/puff of Albuterol. 200 puffs/canister	2 - 3 puffs q 6 hours	1 - 2 puffs q 8 hours
	Nebulizer solution 0.5 mg/3 mL ipratropium bromide and 2.5 mg/3 mL Albuterol	3 mL q 4 - 6 hours	1.5 - 3 mL q 8 hours

Systemic Corticosteroids

Methylprednisolone	2, 4, 8, 16, 32 mg tablets	Short course "burst": 40 - 60 mg/day as single or 2 divided doses, for 3 - 10 days (applies to first three corticosteroids)	Short course "burst": 1 - 2 mg/kg/day, maximum 60 mg/day, for 3 - 10 days (applies to first three corticosteroids)
Prednisolone	5 mg tablets, 5 mg/5 cc, 15 mg/5 cc		
Prednisone	1, 2.5, 5, 10, 20, 50 mg tablets; 5 mg/cc, 5 mg/5 cc		
(Methylprednisolone acetate)	Repository injection 40 mg/mL 80 mg/mL	240 mg IM once	7.5 mg/kg IM once

* Children ≤ 12 years of age (Please refer to package insert for age appropriateness and drug interactions)

Above list not all inclusive. Check for availability and health plan/insurance formulary when applicable.

For emergency asthma exacerbations: see the Guidelines for the Diagnosis and Management of Asthma, Expert Panel Report 2 NIH Publication No. 97-4051, April 1997

Use of a spacer/holding chamber is recommended with the use of a metered-dose inhaler (MDI).

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